Implementation of Amalgam Separators at Navy Dental Clinics

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Outline

- Are separators effective in decreasing Hg levels in WWTP influent?
- US Navy's implementation of amalgam separators
- USEPA's National Waste Minimization Partnership Program
- GLNPO funded dental Hg working group

Do Separators Work?

- Toronto – 5th largest city in North America and has over 1,100 dental practices
- Sewer use by-law – July 6th 2000
- Requires P2 plan and separator installation by January 1st, 2002
- Discharge limit of 0.01 mg/liter as originally passed
- P2 plan: type of vacuum system type of separator, frequency of maintenance & service, plumbing schematics, SOPs for waste generation, storage, handling, disposal of scrap amalgam

Do Separators Work?

- Since Installation of separators in Toronto there has been 58% reduction in Hg levels in WWTP biosolids (sludge)
- Total mass of Hg in combined sludge reduced from 17 kg to 7 kg per month
- Data obtained when compliance with Toronto sewer by-law estimated to be 800 of 1100 dental clinics (~73%)

Do Separators Work?

- MCES is POTW of Minneapolis/St. Paul, Minnesota
- Study done in Hastings and Cottage Grove
- 24 of 25 dentists in these communities participated in study
- Separators in place for 3 month
- 44% and 29% reductions in Hg levels in WWTP biosolids

Do Separators Work?

- NSSD in Gurnee, IL required Naval Base Great Lakes to install separators
- 20% of WWTP influent comes from base
- Base has end of pipe Hg discharge limit of 0.5 μg/liter, soon to be lowered to 0.1 μg/liter
- History of Hg exceedances from base
- Dental clinics on base use 60,750 double spill amalgam capsules per year (~60 lbs of Hg)

Do Separators Work?

- First pretreatment system was installed in largest clinic in 1996
- Since then all dental clinics have systems installed
- 52% decrease in Hg levels in sludge biosolids since separators installed
- Yearly NOVs have decreased from 54 to 3

Do Separators Work?

- Duluth Minnesota active since 1993
- 50 dental practices with ~100 dentists
- Separators installed on a voluntary basis
- Hg in biosolids decreased from 2.5 mg/kg to 0.19 mg/Kg
- WWTP Hg influent has decreased from 0.18 lbs/day in 1993 to <0.02 lbs/day today
- Hg in WWTP effluent decreased from 20.6 ng/liter to 1.9 ng/liter

Do Separators Work?

- Denmark country twice the size of Massachusetts and active in environmental issues for many years
- Dr. Arenholt-Bindslev wrote one of first papers looking at environment aspects of amalgam
- Survey showed 73% of Danish counties have separators in all dental offices
- Half of WWTPs surveyed showed a significant decrease in sludge Hg levels – 14-to-80%

Do Separators Work?

- AMSA – Association of Metropolitan Sewage Agencies – is currently looking at separator efficacy
- Multi-site effort tracking Hg levels in WWTP influent, effluent as well as in biosolids
- Ongoing study still in data collection phase
- Should help to provide additional evidence for or against separator efficacy

U.S. Navy Implementation of Separators

- Navy has over 170 dental clinics with over 2500 chairs *(not counting ship board DTFs)*
- Clinics range in size from 120 chairs to single chair clinics
- Navy program to install separators arose out of problems at NDC Norfolk in Virginia
- Navy program to install amalgam separators in Navy dental facilities at home, overseas and on ships

U.S. Navy Implementation of Separators

- NIDBR has conducted performance studies on commercially available separators
- Designed, built and installed our own systems *(Institute holds 2 patents)*
- Currently installing systems that remove both amalgam particulate as well as dissolved Hg species – *2 phase pretreatment approach*
- Our studies have shown dissolved Hg can be present in substantial concentrations

U.S. Navy Implementation of Separators

- We have seen dissolved Hg levels in dental-unit wastewater as high as 8000 μg/liter
- In large clinics, install SolmeteX Hg10 & Hg20 and ADA Technologies MRU30 and MRU400
- In smaller clinics we install ADA Technologies MRU10
- These systems use filtration and/or settling, oxidation and Hg^{+2} specific resins and sorbents

U.S. Navy Implementation of Separators

ADA Technologies, Inc. Pretreatment Systems

Model Number	Clinic Size	Dimensions of Units	Description of System
BU10	6	8.5”x22”	Particle separator
MRU10c	6	16”x12”x24”	Particles and Dissolved Hg
BU30	12	13”x25”	Particle separator
MRU30	12	13”x25” and 24”x12”x24”	Particles and Dissolved Hg
Custom	100	24”x36”x78” and 21” tank	Particles w/ or w/o dissolved Hg removal
Custom	200	37”x48”x79” and 26” tank	Particles w/ or w/o dissolved Hg removal

U.S. Navy Implementation of Separators

SolmeteX
Hg20

ADA Technologies
MRU 10

U.S. Navy Implementation of Separators

ADA Technologies
BU10

ADA Technologies
MRU 190E

U.S. Navy Implementation of Separators

ADA Technologies MRU 750s Installed at the Dental School in San Antonio, Texas. The school has 400 dental chairs.

U.S. Navy Implementation of Separators

Clinical evaluation of MRU10c

- Mean Baseline Hg concentration 15,400 μg/liter
- Treated wastewater Hg concentration was 8.95 μg/liter (n=45, SD=12.7)
- 99.94% removal efficiency based on concentration

USEPA Waste Minimization Partnership Program

National Waste Minimization Partnership Program

USEPA Waste Minimization Partnership Program

- Effort to form voluntary partnerships to reduce generation of hazardous wastes containing any of 30 Waste Minimization Priority Chemicals *(WMPCs)*
- Goal is to reduce the quantity of WMPCs found in hazardous waste by 50 percent by 2005 *(from 1991 baseline)*
- Encourages manufacturers to reduce WMPCs through source reduction and, where source reduction is not practical, through environmentally sound recycling

USEPA Waste Minimization Partnership Program

- Dow Chemical Company, Texas
- Toyota Motor Manufacturing, Indiana
- American Video Glass Company
- BP Products North America, Inc.
- U.S. Steel Corporation: Mon Valley Works, PA
- Uniseal, Incorporated - Foam Division
- Department of Army: Tobyhanna Army Depot, PA
- Hewlett Packard: Aguadilla, PR
- General Electric Consumer Products
- E.I. du Pont de Nemours and Company
- International Truck and Engine Corporation

USEPA Waste Minimization Partnership Program

- US Navy – NIDBR has started the enrollment process for this program
- Focusing on dental mercury and installation of separators in Navy dental treatment facilities
- EPA Region 5 POC is Janet Haff
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  - USEPA Office of Solid Waste

GLNPO Dental Mercury Working Group

- Delta Institute, University of Wisconsin - Extension Solid and Hazardous Waste Education Center, Erie County Department of Environment and Planning *(Buffalo NY)* , US Navy *(NIDBR)*
- Developing DVD and streaming video to demonstrate BMPs for dental offices
- Out reach to state and local dental societies
  - ***Ohio Dental Society***
  - ***Wisconsin Dental Association***